IF9.

A New Method to Quantify Aortic Biomechanics In Vivo Using Four-Dimensional Magnetic Resonance Imaging (4D MRI): Implications for Ascending Aortic Endografts

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Objectives: The thoracic aorta is subject to physiological forces from cardiac and respiratory motion which have an important effect on endograft failure such as fracture, migration and endoleak. This study's aim was to develop new methodology to accurately measure aortic biomechanics in vivo using 4D MRI and image registration techniques.

Methods: These consisted of: 1.Development of 4D MRI acquisition schemes; 2.Optimization of non-rigid image registration algorithm and assessment of accuracy (TRE); 3.Quantification of aortic biomechanics in vivo.

Results: High spatial resolution 4D dynamic imaging sequences were developed to separately determine the displacement of the aorta caused by cardiac and respiratory motion. The registration algorithm was accurate [TRE-cardiac: 2.05 ± 1.27 mm; TRE-respiratory: 1.60 ± 0.88 mm] and robust to changes in registration parameters. The biomechanical displacement of the ascending aorta (6.41 ± 1.87 mm) was significantly greater than the arch (3.75 ± 0.79 mm) ($P < .0001$(95%CI 1.7-3.6)) and descending aorta (3.64 ± 0.87 mm) ($P < .0001$(95%CI 1.8-3.7)). The motion of the arch was not significantly different to the descending aorta ($P = .68$ (95%CI-0.4-0.6)). The maximum displacement caused by cardiac and respiratory motion was 16.9 mm and 7.7 mm respectively. Significant inter-individual differences in aortic deformation and dynamic curvature were seen. Maximal displacements occurred at peak systole in the ascending aorta and arch whereas in the descending thoracic aorta there was minimal change with time. In the ascending aorta there was a large rotational component, demonstrated by large RL (4.71 ± 0.52 mm) and AP displacements (2.65 ± 0.76 mm).

Conclusions: We have successfully developed, validated and applied a new method to quantify aortic biomechanics in vivo. The motion of the ascending aorta is complex, multidirectional and significantly greater than the arch and descending aorta. These data will inform ascending aortic endograft design and advance durability and deployment accuracy.

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S1: William J. von Liebig Forum

SS1.

Post-Discharge Outcomes After Endovascular Abdominal Aortic Aneurysm Repair

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Objectives: Outcome improvement in the field of aortic surgery, specifically endovascular repair (EVAR) of abdominal aortic aneurysms (AAA), has received much attention. The focus, however, has been on inpatient outcomes. With EVAR, the index hospital stay after aortic surgery has decreased significantly, leaving a need for better understanding of post-discharge outcomes, which is necessary to improve quality and reduce readmission rates with proper targeted outpatient interventions. The objective of this study was to examine post-discharge 30-day outcomes after elective EVAR.

Methods: Patients who underwent an elective EVAR for AAA (n = 11,229) were identified from the ACS' 2005-10 NSQIP database. Univariable and multivariable logistic regression analyses were performed.

Results: The median age for the patient cohort was 75 years with 82.7% males. The median (interquartile range [IQR]) length of hospital stay was 2 (1-3) days. Overall 30-day mortality rate was 1.0% (n = 117), with 31% (n = 36) of the patients dying after discharge. Overall 30-day morbidity rate was 10.7% (n = 1204), with 37.9% (n = 456) of the morbidities being post-discharge. The median time of death and complication was 9 and 3 days, respectively, after surgery. Eighty-one percent of the wound infections (n = 190/234), 28% of pneumonia (n = 37/133), and 51% of DVT (n = 27/53) were post-discharge. On multivariable analyses, age, dependent functional status, postoperative pneumonia, and postoperative renal failure were independently associated with post-discharge mortality, and female gender and diabetes with post-discharge morbidity ($P < .05$ for all).

Conclusions: A third of deaths and complications after EVAR are post-discharge. Improved pre-discharge surveillance and close post-discharge follow-up of identified high-risk patients may further improve 30-day outcomes after EVAR. Post-discharge interventions are needed and should focus on complications with high rates of occurrence after the index hospitalization.

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SS2.

A Propensity-Matched Comparison of Fenestrated EVAR and Open Surgical Repair of Complex Abdominal Aortic Aneurysms

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Objectives: The benefit of fenestrated EVAR (FEVAR) to open surgery repair (OR) of complex